

# Class size and academic results, with a focus on children from culturally, linguistically and economically disenfranchised communities<sup>1</sup>

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## Abstract

The question of class size continues to attract the attention of educational policymakers and researchers alike. Australian politicians and their advisers, policy makers and political commentators agree that much of Australia's increased expenditure on education in the last 30 years has been 'wasted' on efforts to reduce class sizes. They conclude that funding is therefore not the problem in Australian education, arguing that extra funding has not led to improved academic results. Many scholars have found serious methodological issues with the existing reviews that make claims for the lack of educational and economic utility in reducing class sizes in schools. Significantly, the research supporting the current policy advice to both state and federal ministers of education is highly selective, and based on limited studies originating from the USA. This comprehensive review of 112 papers from 1979-2014 assesses whether these conclusions about the effect of smaller class sizes still hold. The review draws on a wider range of studies, starting with Australian research, but also includes similar education systems such as England, Canada, New Zealand and non-English speaking countries of Europe. The review assesses the different measures of class size and how they affect the results, and also whether other variables such as teaching methods are taken into account. Findings suggest that smaller class sizes in the first four years of school can have an important and lasting impact on student achievement, especially for children from culturally, linguistically and economically disenfranchised communities. This is particularly true when smaller classes are combined with appropriate teacher pedagogies suited to reduced student numbers. Suggested policy recommendations involve targeted funding for specific lessons and schools, combined with professional development of teachers. These measures may help to address the inequality of schooling and ameliorate the damage done by poverty, violence, inadequate child care and other factors to our children's learning outcomes.

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It would be reasonable to ask 'Why another paper on class size?' For most the issue seems to have been settled: smaller classes promote higher achievement, better attitudes, different instructional practices, and higher teacher satisfaction and morale. Technical criticisms of methodology ...and less-substantiated criticisms of research ...would not change the general interpretation of meta-analyses in this area (Bourke 1986, 558).

Many policymakers and political commentators suggest that funding isn't the problem in Australian education. They point to the funding spent on reducing class sizes, arguing that this extra funding does not lead to better academic results.

Politicians and their advisers seem to agree, as they claim that much of Australia's increased expenditure on education in the last 20 to 30 years has been 'wasted' on efforts to reduce class sizes. The class size issue also directs attention to the learning environment, while pupil/teacher ratio is typically an economic category illustrating the amount of money spent.

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<sup>1</sup> CLED. The term 'disenfranchised' is preferred over the more common 'disadvantaged' as it has no connotations of *deficit* and suggests these communities are in fact denied their legitimate place in society

Most of this policy advice and commentary relies heavily on Jensen's report (2010) on Australian education and teacher quality. Jensen suggests that the majority of studies around the world have shown that class size reductions do not significantly improve student outcomes, and that the funds should have been redirected toward enhancing teacher quality. This paper seeks to determine whether the literature *does* confirm that class size reduction (CSR) makes no significant impact on student achievement generally, and in particular CSR's impact on lower achieving children from Culturally, Linguistically and Economically Disenfranchised (CLED) communities. Although the results of individual studies are always questionable, a range of newer peer reviewed studies on the effects of small classes have now emerged, and they throw into doubt this advice being offered to policymakers in Australia.

### **The criteria for literature included in this review**

This review draws on a wide range of studies that assess the different measures of class size and how they affect student results. The studies originate from Australia and New Zealand, and also from similar education systems including Canada and European non-English speaking countries. I employed the following strategies in determining which studies to include in the review:

1. A keyword search (class size reduction, student achievement, minority, disadvantage, pedagogy) on relevant research databases (A+ Education, CBCA education – formerly the Canadian Education Index, ERIC, Expanded Academic, Informit Online, ProQuest Education, PsychInfo).
2. Examination of the references of seminal research papers and reviews that reported positive and negative findings. In particular I looked for studies that reported a negative impact of CSR.
3. Examination of the papers to determine which studies have taken into account variables other than class size that may affect teaching quality (such as teaching methods).

This search yielded a total of 112 articles for review. I then assessed the selected studies according to whether they took the following factors into account:

1. Both the direct benefits of smaller class size (if there are any), and the indirect benefits. For example, does any evidence bear on the relationship between class size and the ability for schools to attract and retain quality teachers?
2. Whether schools might compensate for larger class size by employing teacher aides.
3. Whether socio-economic factors modify the effect of class size on scholastic outcomes. It seems entirely possible that smaller class sizes might be effective in areas of highly concentrated levels of disadvantage, with large proportions of high need students. This has particular relevance to the Australian and New Zealand context, where regional variation in school performance is stark.

Noticeably, of the papers included in this review, only three authors supported the notion that smaller class sizes did not produce better outcomes to justify the expenditure.

## Why small class sizes?

Parents and teachers often have strong views about the effects of class size. Probably all of us would take the view that – other things being equal – children are more likely to receive a better quality of education in small classes (Blatchford and Mortimore 1994, 412).

Reducing class size to increase student achievement is an approach that has been tried, debated, and analysed for many decades. The premise seems logical: with fewer students to teach, teachers should achieve better academic outcomes for all students. For those who choose private education for their children in Australia, it is often cited as a major consideration (Anderson 2013; Beavis 2004; Lye and Hirschberg 2012).

However, for policymakers there are three major questions to answer with the adoption of any change or new program: how effective will the change be; how much will it cost; and what are the problems of implementation, including the support or opposition of the stakeholders – in this case principals, teachers and parents – and those who implement it (Folger and Breda 1989)? The current federal minister of education (Pyne 2012) is on record as declaring:

There is no evidence that smaller class sizes somehow produce better student outcomes. In spite of Australia having small class sizes for 10 years...their outcomes have gone backwards.

Moreover he confirmed that a Coalition Government would actually increase class sizes in Australian schools. A main reason for caution is that any commitment to smaller classes necessarily involves more teachers, and this has considerable resource implications for policy makers (Blatchford et al. 1998), especially under conditions of what the federal treasurer has termed a ‘budget emergency’ (Sloan 2013).

## Facts on Australian class size

It is commonly assumed that class sizes in Australia are smaller than they have ever been. This is not the case. While older members of our society may recall being in classes of 40 or more students in the 1950s and early 1960s, by 1981 class sizes in Australia were generally capped at 25 in high schools and 22 in technical schools. These caps have increased since their low point in 1981, even in primary schools; while the early years in many jurisdictions are capped below 26, grades 3-6 are treated like secondary classes and capped between 28 and 30.

Class size research has a protracted and controversial history, especially in the USA, England, and Australia. Is there evidence that pupils taught in smaller classes do better in academic and other non-cognitive outcomes than pupils in larger classes?

In Australia commentators and politicians alike (Ashenden 2013; Buckingham 2003a; 2003b; 2003c; Donnelly 2012; Gillespie 2014) point to high performing systems such as Shanghai, Hong Kong, South Korea, Taiwan and Singapore, where large class sizes are the norm, as evidence that reducing class sizes is a futile exercise. But research by Biggs (1998) indicates that students from Confucian heritage cultures are socialised in ways that make them amenable to work in large classes, so that management problems are minimal and teachers can focus on meaningful learning using whole-class methods. An educational system forms a working whole, each component interacting with all other components. Isolating any one component (such as class size) and transplanting it into a different system shows a deep misunderstanding of how educational systems work.

An accurate determination of actual class sizes in Australia is problematic. Moreover, different States and territories collect data on class sizes at different times of the year; students and teachers come and go; and teaching groups change. Student-teacher ratios (STRs) are calculated by dividing the full-time equivalent students on a school's roll by the full-time equivalent number of qualified teachers. STRs are different from class sizes because they also count teachers who are not at the 'chalk-face', such as Physical Education, Library, Welfare, Careers teachers and Principals. All the enrolled students are divided by all the teachers in the school, yet it should not be assumed that teachers entered into the ratio are teaching for all the time. Past research has too often conflated STR with class size (Akerhielm 1995; Biddle and Berliner 2002).

In 2010 Australia's average public primary class size (not STR) was 23.2 – above the OECD average of 21.3 and EU average of 20. This compares to 15 in Korea; 17 in Germany and the Russian Federation; 19 in Finland; 20 in the UK, Poland and Luxembourg; and 26 in India (OECD 2013). Class sizes are smaller in both the Independent and Catholic sectors in Australia.<sup>2</sup>

### **What kind of research is available on class size effects?**

There are three types of research into the impact of class size on student achievement (Blatchford and Mortimore 1994). The first looks for correlations between the size of class and student results. Findings from this research could be explained by other factors: are poor low achievers placed in smaller classes that would reduce the impact of attainment; are teachers obliged to use different pedagogies in larger classes; or are better and more experienced teachers given the larger classes (Akerhielm 1995)?

The second type of research involves taking the results from large numbers of research projects and combining them into a single meta-analysis. One of the first and most famous studies to use meta-analytical tools was Glass and Smith (1979), which analysed 80 separate studies from 1925 to 1978. Glass and Smith (1978, i) concluded that there was a substantial relationship between class size and achievement:

As class-size increases, achievement decreases. A pupil, who would score at about the 63rd percentile on a national test when taught individually, would score at about the 37th percentile in a class of 40 pupils. The difference in being taught in a class of 20 versus a class of 40 is an advantage of ten percentile ranks ...Few resources at the command of educators will reliably produce effects of that magnitude.

Similarly, in 1979 Glass and Smith (1979, 2) declared:

There is no point in recording the obvious about class size: that teachers worry about it more than nearly anything else, that administrators want to increase it, that it is economically important, and the like. The problem with class size is the research. It is unclear. It has variously been read as supporting larger classes, supporting smaller classes, and supporting nothing but the need for better research ...Review after review of the topic has dissolved into cynical despair or epistemological confusion. The notion is wide-spread among educators and researchers that class size bears no relationship to achievement. It is a dead issue in the minds of most instructional researchers. To return to the class-size literature in search of defensible interpretations and conclusions strikes many as fruitless.

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<sup>2</sup> In 1970s the average class size in Catholic schools was 40 in the primary schools and 36 in secondary schools. Twenty five years later, average class sizes have halved (Canavan, 1999). The same is true for independent schools, especially the high fee 'elite' schools who promote their schools with the fact that they run 'small classes' <[www.finder.com.au/public-and-private-schooling](http://www.finder.com.au/public-and-private-schooling)>.

Significantly, this meta-analysis found that the small-class size effect does not differ appreciably across different school subjects, levels of pupil ability, or several other obvious demographic features of classrooms. Glass and Smith (1980) concluded that there was a clear and strong relationship between class size and student achievement: compared with a class of 30 students, students in a class of 15 students perform about 15 percentile points higher.

Slavin (1989, 99) responded to Glass et al. and other early proponents of CSR, rejecting their findings as unfounded claims. He re-analysed their evidence and concluded:

The search for substantial achievement effects of reducing class size is one of the oldest and most frustrating for educational researchers. The search is approaching the end of its first century; eventually, it may rival the search for the Holy Grail in both duration and lack of results.

However, Slavin conceded that Cooper's (1989) conclusion that 'low achievers<sup>3</sup> in the early grades [are] the group most likely to benefit from smaller classes' (p. 109) is valid. He suggested that 'reducing class size may be justified on morale and other quality-of-life grounds. However, as a means of increasing student achievement, even substantial reductions in class size have little apparent impact' (1989, 106). He also argued that long-term studies indicate that any positive effects are not cumulative across grades, and may even disappear in later years.

Early discussions of the small achievement effects related to reductions in class size found that changes to teachers' behaviours and instructional methodology (pedagogy) did not vary much with size of classes (Cahen et al. 1988; Robinson and Wittebols 1986; Shapson et al. 1980). This was later supported by Hattie (2005; 2008).

Slavin (1989) hypothesised that class size could also have a substantial indirect effect on student achievement, as there may be highly effective pedagogies that could not be successfully implemented in large classes. One of the earliest Australian studies sought to test the validity of these claims in year 7 classrooms in the Australian Capital Territory (Larkin 1983; Larkin and Keeves 1984). The researchers examined the types of activities present in classes of varying sizes, and the effects of these activities upon educational outcomes. They found a relationship between class size and achievement, but they asked whether class size affects achievement and attitudes directly, or through the different teaching environments and practices that are possible in classes of differing sizes. By grouping the more able students in larger classes, teachers were able to focus more individualised attention on lower achieving students; the findings also indicated achievement gains beyond those expected solely from a consideration of differences in achievement levels.

The third type of research is experimental (e.g. Blatchford and Mortimore 1994), and compares the progress of pupils who have been randomly allocated to classes of different sizes, and teachers allocated randomly to classes of different sizes. This is further discussed in more detail below. While this provides the highest level of evidence for a single study, a well-conducted quasi-experimental approach may also provide a very high standard of evidence.

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<sup>3</sup> It is unclear whether Slavin is referring to low achievers or students from CLED communities.

## The role of teacher pedagogy: Australian research

Bourke's (1986) research in Melbourne sought to understand the link between reduced class size and improved student achievement, and the teacher practices identified by Glass and Smith (1979; 1980) and Cooper (1989) that produced higher student engagement. Involving 63 Year 5 teachers in 33 government elementary schools (at least two teachers in each school), his study analysed the methods teachers used over a school term, with a minimum of ten observations of each teacher's class. Bourke (1986, 559) set out to determine:

What are the practices that produce the higher student engagement rate that has been identified as being linked to class size and to achievement? What methods do teachers use when individualizing instruction that they do not use, or use less frequently, under grouped or whole class instruction? What methods do teachers use when individualizing instruction that they do not use, or use less frequently, under grouped or whole class instruction? What form does the greater attention given to students in smaller classes take?

The classes ranged from 12 to 33 students per teacher, with a mean of 25.2. Taking student, school and teacher variables, along with class size, as independent variables, only student ability and class size were directly linked to achievement. Bourke concluded that different pedagogies in classes of different size caused variations in achievement.

In larger class sizes teachers used class groupings, and these classes had lower achievement, while in smaller classes it was more common to teach to the whole class. There were more student questions in larger classes (usually seeking help or clarification), but more teacher *follow-up* of questions in smaller classes. There was a greater use of homework, assignments and oral tests for assessment purposes in smaller classes. The amount of time teachers spent directly interacting with students, and monitoring students' work, was differently related to class size; more direct interaction occurred in smaller classes, whereas teachers lectured or explained more in larger classes. Finally, larger classes had fewer interactions overall between teachers and students, had higher noise levels, required more management than smaller classes, and the time spent in this way did not assist student learning.

Teachers with smaller classes tended to wait more often.<sup>4</sup> When teachers probe and wait frequently, class time is taken up. As teachers apparently need to spend less time on managing a smaller class, they have more time for probes and waiting, which are more productive uses of lesson time. Two of the general classroom processes that Glass et al. (1982) suggested as potentially important, namely student engagement rate and individualisation, were not found to be of consequence in this study, but the greater attention given to students through aspects of questioning was important for achievement (Bourke 1986).

These early studies revealed a substantial relationship between class size and teacher and pupil attitudes, as well as instruction. High achievement in smaller classes is mediated through teacher pedagogy. Moreover they found favourable teacher effects (workload, morale, attitudes toward students) were associated with smaller classes, as were favourable effects on students (self-concept, interest in school, participation). Significantly, Smith and Glass (1980) were confident that smaller classes were associated with greater attempts of teachers to individualise instruction

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<sup>4</sup> Response latency, which is controlled through teacher wait time, refers to the duration between presentation of a discriminative stimulus, such as a teacher's question or instruction, and a student's response to that stimulus (Lamella and Tincani 2012).

while producing an improved classroom climate. Smith and Glass (1980) also quantified the class-size effect for different age groups, and found that the effect was greatest for pupils 12 years and under, somewhat less for pupils 13 to 17, and least for pupils 18 and over.

### **Project STAR and SAGE: Very different conclusions drawn from the same evidence**

Much of the research evidence still being debated arises from two projects: STAR (Student-Teacher Achievement Ratio) in Tennessee from 1985-1989; and Prime Time in Indiana and SAGE in Wisconsin.

Strong claims have been made for the success of the STAR research (Achilles et al. 1993), but these have been accompanied by equally strong critiques (Slavin 1989; 1990), and the advocacy of alternative educational initiatives, such as one-to-one tutoring (Wasik and Slavin 1993). Recognised in the education research community as the most reliable and valid research on the impact of class size reductions at that time, the Tennessee STAR project was a large series of randomised studies, followed up in Wisconsin by the SAGE project.<sup>5</sup> After four years, it was clear that smaller classes did produce substantial improvement in early learning and cognitive studies, and that the effect of small class size on the achievement of minority children was initially about double that observed for majority children; in later years, it was about the same (Mosteller 1995).

Folger and Breda (1989) re-analysed Project STAR data and concluded that small class achievement advantage was found in all kinds of schools: inner city, suburban, rural, and urban. However, the small class advantage was largest, on the average, in inner-city schools<sup>6</sup>, and the effect sizes were larger for numeracy than literacy in all four grades. This could be explained by the fact that reading instruction was already done in small groups, where the overall size of the class makes less difference. Numeracy teaching, on the other hand, was normally done with the whole group, and class size made more of a difference (Glass and Smith 1979; 1980). Small classes made the most difference for student at Preparatory and First Grade level. Folger and Breda (1989) found that small classes assisted low SES students' achievement as much as high SES, and reduced instances of grade retention or repeating classes.

Significantly, teachers reported they had not modified their teaching as a result of the training received as part of Project STAR. In the follow-up year (Grade 4), when all students were in regular-sized classes, there was still a significant achievement advantage for the students who had been in small classes. Students in small classes were about a month ahead of students in regular classes at the end of kindergarten, and about two months ahead at the end of Grade 1.

However, the results from experimental studies indicate that the non-random allocation of students and teachers to small classes may actually mask the true

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<sup>5</sup> STAR was a large-scale, controlled study of the effects of reduced class size, conducted in 79 elementary schools in the state of Tennessee from 1985 to 1989. The Student Achievement Guarantee in Education (SAGE) program was launched in Wisconsin in the 1996-1997 school years. More than 3000 kindergarten (preparatory) and first grade students attended SAGE schools in the first two years of the program. Evaluators compared the scores of these students with the scores of more than 1600 students in comparable district schools with similar socioeconomic demographics. SAGE classrooms that had 12-15 students were compared to mainstream classes of 21-25.

<sup>6</sup> In the USA, inner-city schools is a term used to describe schools with high levels of minority and disadvantaged students.

relationship between class size and student achievement (Akerhielm 1995), where lower performing students are disproportionately allocated into small classes.

*What is taught? How is it taught? How are students responding?*

Finn and Achilles (1990) conducted a large-scale experiment in 1986 with 5-6 year old students and teachers randomly assigned to small (13-17) and large classes (22-25). Participants came from 76 elementary (primary) schools over 2 years, and comprised 6,570 students in 331 classes. About 70% of the sample came from CLED communities. At the end of each year students were assessed in reading and mathematics by standardised curriculum-based tests. Significantly, teachers were not given any special training to work with the smaller classes.

Contrary to Slavin (1989), they found a significant achievement benefit in reading and mathematics in the smaller classes, in particular for CLED students. Moreover, longitudinal gain in reading outcomes increased during the second year. Finn and Achilles point to three important pedagogical and curriculum factors: 'What is taught? How is it taught? How are students responding?' They highlight the impact of pedagogy in combination with small classes; the impact of increased individual teacher-student interactions; and the extent to which students are more authentically engaged with learning in smaller classes.

Similar to Slavin, Odden (1990, 213) re-analysed previous meta-studies and argued that 'only targeted class size reductions coupled with other changes [in pedagogy and teacher practice] are likely to produce achievement gains that can justify large investments of new funds'.

Filby et al. (1980) studied teacher pedagogy in small classes, and found that:

- Teachers were more able not only to complete their lessons in smaller classes, but to develop their lessons in more depth;
- Teachers moved through curricula more quickly and were able to provide additional enrichment activities;
- Teachers reported that they managed their classes better, and classes functioned more smoothly as less time was spent on discipline and more on learning;
- Students received more individualised attention, including more encouragement, counselling, and monitoring;
- Students were more attentive to their classwork;
- Students had to wait less time to receive help or have their papers checked, and they had more opportunities to participate in group lessons.

Odden concluded: 'it seems that smaller classes at least provide several opportunities for teachers to engage in instructional strategies shown by research to be related to higher student performance' (1990, 219). However, too many teachers continued to teach small classes in the same way they taught larger ones, instead of implementing teaching and learning pedagogies that focussed on student-centred learning and small group inquiry interactive work based on the latest constructivist research (Bruner 1987; Vygotsky 1980), and recommended as best practice by major education authorities (at least in Australia).<sup>7</sup>

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<sup>7</sup> See for example the Victorian education department's Principles of Learning and Teaching (POLTs) <[www.education.vic.gov.au/school/teachers/support/pages/principles12.aspx](http://www.education.vic.gov.au/school/teachers/support/pages/principles12.aspx)> and the e5 Instructional Model <[www.education.vic.gov.au/school/teachers/support/Pages/e5.aspx](http://www.education.vic.gov.au/school/teachers/support/Pages/e5.aspx)>.



Blatchford<sup>8</sup> and Mortimore suggest that this first phase of research into class size has led to ‘very different conclusions [that] have been drawn from the research evidence, sometimes the same research evidence ...[where] long running disagreements amongst researchers have in recent years reached a new vehemence’ (1994, 412). They also suggest that research needs to focus on what they term the ‘mediating processes’ (1994, 703) and investigate ‘direct and indirect’ (1994, 704) effects identified on the basis of past research as likely to be important: individualization of teaching, quality of teaching, curriculum coverage, pupil attention, better teacher control and less time spent on managing pupils’ behaviour, more time and space, better morale, and better pupil-pupil relations.

Blatchford and Mortimore (1994) asked how class sizes have changed, what is known about the link between class size and educational achievement, and what aspects of classroom processes might explain any link. They concluded that there is firm evidence for the claim that small class sizes impact on student achievement, but only in the early years and only with classes smaller than 20, especially with pupils from CLED communities.

As Blatchford and Mortimore (1994) explain, not only is it important to be able to break down the figures by student age, but also by location and the SES of the catchment community. Class sizes when children start school have very different implications from those in later years, such as Grade 5 or 6. Class sizes also have different impacts for students from CLED communities compared to those from the ‘leafy suburbs’, as Bourdieu’s research on *habitus* and cultural capital and Bernstein’s research on social class and language suggest (Bourdieu 1991; Bourdieu and Passeron 1990; Bourdieu and Wacquant 1992; see also Bernstein 1971; 1996; Bernstein and Morais 2001). Blatchford and Mortimore, reflecting on the situation in England, state that ‘it is curious, to put it mildly, that the youngest pupils in the system, who are least able to learn independently and therefore the most dependent on adult help, usually experience the biggest classes’ (1994, 416).

Akerhielm (1995) re-analysed pupil-specific public school data from Project STAR that had been unavailable in previous studies. She applied instrumental variable econometric methods to account for non-random allocation of students to different class sizes, in order to understand why past literature has produced such inconsistent findings on the effects of class size. She concluded that there are beneficial returns to investing in smaller classes for CLED students.

Mosteller (1995) also agreed that smaller classes did produce substantial improvement in early learning and cognitive studies; and that the effect of small class size on the achievement of minority children was initially about double that observed for majority children, but in later years it was about the same. The magnitude of such effects did not vary significantly across schools (Shin and Raudenbush 2011).

Analysing data from all of the Grade 4 and 5 mathematics and reading scores for the entire school system of a Florida county (encompassing over 15,000 students), Borg et al. (2012) used a multilevel model to show that school resources do matter. They found that not only do high quality teachers have a significant and positive effect on student test scores, but smaller class sizes, especially in low performing schools,<sup>9</sup> contribute to higher student achievement.

Blatchford et al. (1998) reviewed 1994/95 research by OFSTED in England. At the time, class sizes in the early primary years were well over 30 children, and the

<sup>8</sup> This is Blatchford’s first of many papers on the class size issue. Writing from England where at that time class sizes were actually increasing in size, he is the pre-eminent researcher in this field today.

<sup>9</sup> Usually found in urban and CLED communities.

research claimed that ‘class size makes little difference’. However, Blatchford et al. (1998) note that ‘even in [OFSTED’s] own terms evidence was found for a link between class size and the quality of teaching and learning at [early primary grades] – a finding that appears consistent with other studies that support a class size effect’ (1998, 699). Blatchford’s conclusions drawn from his case study of small class sizes in early primary classrooms found that:

- Teachers appeared able to maintain control and a level of attention and noise that helped the pupils’ work;
- teachers appeared able to control and reinforce appropriate behaviour.
- Teachers appeared able to organize pupils’ work efficiently and to get them ready for a task so they were clear what to do;
- Teachers appeared able to develop a teaching point and could explain the point and consolidate the children’s understanding of it;
- Teachers appeared able to offer the pupils feedback, pitched to their individual levels of understanding; check their knowledge and grasp of a topic; offer feedback that was appropriate and encouraging; and then move them on. Thus, the sensitivity and effectiveness of feedback was enhanced;
- Teachers appeared able to pick up on and use events as they came up and then develop them into a teaching point. In a larger class these opportunities can be potentially disruptive and so may be missed or avoided;
- Pupils appeared to be developing good relationships with each other, reinforced by the teacher, so they could help and encourage each other in their work and school behaviour, and point out errors and inappropriate behaviour. It was apparent that their relationships with each other (and the teacher) were friendly, but this appeared to have been carefully nurtured by the teacher;
- Pupils’ ability to get teachers’ attention quickly, and get difficulties dealt with, appeared to be enhanced. They did not have to wait, and hence become discouraged or distracted; consequently, their concentration was more continuous and applied.

The conclusions of Blatchford et al. (1998) are supported by Rice (1999, 226), studying data obtained from high school mathematics and science students:

Class size significantly affects three key instructional strategy variables in mathematics classes: amount of time spent working with small groups, amount of time devoted to innovative instructional practices, and amount of time devoted to whole-group discussions. In all three cases, the effect is negative; teachers in larger classes report doing less of these things.

### *Contrary conclusions*

In response to these seemingly conclusive findings from the work of diverse researchers (Angrist and Lavy 1999; Finn and Achilles 1999; Grissmer 1999; Nye et al. 1999; Rice 1999; Smith et al. 2003), education econometrician Eric Hanushek published a number of papers refuting these conclusions (Hanushek 1997; Hanushek 1998; 1999; 2003; Hanushek et al. 1999; Hanushek and Rivkin 2006). These, together with Hoxby’s (2000) critique, form the basis for the current rejection by both policymakers and media commentators of the relationship of class size and academic results.<sup>10</sup> Hanushek (1998, 131) concludes:

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<sup>10</sup> See for example Jensen’s highly influential and oft-quoted report by politicians and media (Jensen 2010).

Evidence about improvements in student achievement [from the STAR Project] that can be attributed to smaller classes turns out to be meager and unconvincing ...Detailed econometric evidence about the determinants of student performance confirms the general lack of any achievement results from smaller classes ...Widely cited experimental evidence actually offers little support for general reductions in class size.

He claims that ‘a number of important design and implementation issues ...suggest considerable uncertainty about the magnitude of any treatment effects’ (Hanushek 1999, 143).

Unfortunately Hanushek, throughout his papers, falls into the trap detailed earlier of equating student-teacher ratio (STR) with class size, and he uses this as a proxy when reviewing international comparisons (Biddle and Berliner 2002). For example, he writes (1998, 3):

There have been consistent and dramatic falls in pupil-teacher ratios over most of the century ...Over this period the overall pupil-teacher ratio fell 35 percent. This decline is the result of steady drops in the pupil-teacher ratio at both the elementary and the secondary school level. The obvious conclusion from this is that, if there is a problem of class size today, there must have been larger problems in the past.

But he also acknowledges that in certain situations involving ‘specific teachers, specific groups of students, and specific subject matters ...small classes could be very beneficial for student achievement’ (1999, 33).

In reviewing the relationship between school inputs generally and student achievement in education, econometricians Greenwald et al. (1996) challenged Hanushek’s finding that additional school resources are unrelated to improved student outcomes, arguing that effect sizes were large enough to suggest that moderate increases in spending may be associated with significant increases in achievement.

Hoxby’s econometric analysis came to the same conclusion as Hanushek: ‘that class size does not have a statistically significant effect on student achievement and that reductions in class size have no effect on student achievement’ (2000, 1283). Moreover Hoxby declared – contrary to research cited above – that there is ‘no evidence that class size reductions are more efficacious in schools that contain high concentrations of low income students or African-American students’ (2000, 1282). Commenting on a study of Minnesota primary schools, similar to Hoxby’s research in Connecticut, Cho et al. (2012) found only small gains in reading and mathematics from small classes. This may be because small classes benefit students from low income families more than students from high income families, and students from both Minnesota and Connecticut tend to be higher SES.

Borland et al. further investigated optimal class size, and concluded that if ‘the relationship between class size and student achievement is indeed non-linear and non-monotonic, the failure to allow for such a possibility in the choice of a functional form estimated in previous studies would, itself, explain the confounded results of such studies’ (2005, 78). Despite this, based on their calculations, the optimum class size would still be between 21 to 23 students.

Hanushek and Hoxby seem to stand alone in their findings that class size reduction has little or no impact on student academic outcomes – yet they are disproportionately referred to for evidence here in Australia (Ashenden 2013; Buckingham 2003a; 2003b; 2003c; Donnelly 2012; Gillespie 2014).

An Australian researcher (Hunter, 2000) found evidence from previous studies in primary schools in Brisbane, Queensland (Campbell, 1990) and Burke County, Carolina from 1990 to 1995 that “students in the smaller classes outperformed the

comparison group in all three grades on both reading and mathematics achievement tests” (Hunter, 2000, p. 42). Further, the percentage of classroom time devoted to instruction in the smaller classes increased from 80 to 86 percent compared to the larger classes, while the percentage of time devoted to non-instructional activities such as discipline correspondingly decreased.

Hunter explains that the apparent failure of the California CCSR program to immediately improve student scores<sup>11</sup> in 1996-1997 was probably due to the fact that 1.9 million children were assigned to smaller classes without adequate preparation. The State's school districts hired 21,000 teachers with temporary or emergency credentials, both of which were more prevalent in higher poverty, higher minority enrolment schools (Jepsen and Rivkin 2009). Infrastructure resources were also strained; the class size reduction law put many classes into portables or non-classroom space (Ehrenberg et al. 2001). Despite these problems, CSR still had a positive and significant influence on Californian students' longitudinal achievement – between 1996 and 2000, California fourth-graders' test scores in Mathematics increased by between 0.2 and 0.3 of a standard deviation across all demographic groups (Jepsen and Rivkin 2009; Unlu 2005). In the five largest school districts other than Los Angeles (San Diego, San Francisco, Long Beach, Oakland and Fresno), researchers found that class size reduction raised the proportion of third graders who exceeded the national median by 10.5 percent in math, and 8.4 percent in reading.

While Australian commentators (Buckingham 2003a; 2003b; 2003c; Gillespie 2014; Jensen 2010) refer to the failures in California, Ehrenberger et al., (2001, 20) point out that the CCSR program was very problematic: ‘not only was there no randomization, but the policy was implemented across the state very rapidly, and there was no state testing system in place initially. There was also no evaluation design in place before the program was implemented’. Hunter (2000, 146) cites the head of the Centre for School Reform at the Pacific Research Institute in San Francisco, who argued that students pay the price for unqualified teachers:

If you have a class of forty and an excellent teacher, those forty students will perform well. If you divide them into two classes, you have twenty in a class with an excellent teacher and twenty in a class with an inexperienced or perhaps even unqualified teacher. Overall, the scores may decline.

## **The impact on CLED and underperforming students**

A Lasting Benefits Study (LBS) over 15 years of the STAR project found that:

- More students graduated on schedule;
- There was significantly less student attrition;
- ‘More demanding’ subjects were undertaken and successfully completed;
- Mathematics test results were higher;
- There were records and reports of better levels of behaviour, effort, initiative and cooperation;
- More students took up tertiary studies; and

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<sup>11</sup> In fact it seemed that student achievement actually dropped. Standardised tests show that students scored below national averages in up to 43 grade and subject categories. The scores appear even worse for the state's second- and third-graders, most of whom had been in classes of twenty or fewer pupils for the previous two years. On a scale in which 50 is the national average, California's second-graders ranked slightly below national averages in three of four subject areas, and third-graders fell below national averages in all four, with scores of 47 in reading, 46 in language, 46 in mathematics, and 40 in spelling.

- The most significant improvement related to minority and lower economic status groups (Hunter 2000).

These analyses (Finn et al. 2001; Nye et al. 2000) indicate that the more years students spend in small classes during grades K-3, the longer the benefits for achievement last during grades 4-8. These students are more likely to take college-entrance examinations, and this is especially true for CLED students (Finn 2003; Finn et al. 2005), for whom the lasting benefits of four years of small classes reduces racial and ethnic inequality in reading, and gender inequality in mathematics. This is an 'intervention that can simultaneously raise achievement for all students as well as reduce inequality' (Nye et al. 2004, 100). The benefit for black students was substantially greater than for white students, reducing the black-white gap in college-entrance-test taking by 54% (Krueger and Whitmore 2001). For certain grades, in reading and science, low achievers seem to benefit more from being in small classes for longer periods. This reduces the achievement gap in reading and science in later grades, and cumulative small class effects were significant, and meaningful in magnitude (Konstantopoulos and Chung 2009; Konstantopoulos and Li 2012).

Re-examination of the STAR Project results suggests that 'small class effect for minorities is always larger than for whites' (Nye et al. 2000, p.13). Further, Finn and Achilles found that 'the benefit for minority students<sup>12</sup> was about *two to three times as large* as that for Whites' (1999, 100, emphasis in original). The effect in mathematics achievement for minorities was only slightly larger in kindergarten<sup>13</sup> but about 50 percent larger in grade 1, and nearly twice as large in grades 2 and 3. In the case of reading achievement, the small class effect for minorities was about 50 percent larger in kindergarten, and nearly twice as large in grades 1, 2, and 3. Nye et al. (1999) conclude that 'the average effect of small classes is significant and positive in both mathematics and reading at every grade level' (1999, 15), and that (Nye et al. 2000, 24):

Effects of this size imply that the use of small classes in kindergarten through grade 3 for all students could reduce the minority-white achievement gap in reading by one third to one half with a more modest reduction of the mathematics achievement gap.

In Australia, the significant issue is whether CSR may have a greater impact for both particular grades, and for CLED groups (American Federation of Teachers 2003) compared with other groups (Devereaux and Thomson 2001; McCarty 2001). This might help close achievement gaps for CLED and underperforming students, rather than raising average attainment.

In 1997, Peter Cuttance's<sup>14</sup> independent review of these issues for the Western Australian government (Cuttance and Stokes 1997) suggested that the particular contexts in which students benefited from smaller classes were the early years of schooling; the education of students from CLED backgrounds; and those in need of special learning support. This finding was reinforced by a review for the NSW education department of a pilot study of 63 schools provided with additional teachers in order to reduce K-2 class sizes (Meyenn 2003). Extra benefits were observed for

<sup>12</sup> Black, Hispanic, First Nations students. They are also in the lowest SES communities.

<sup>13</sup> In the USA kindergarten refers to what is called preparatory or reception class, the first class at primary school where children are typically 5 years old.

<sup>14</sup> Founding Director of the Education Review Unit in the South Australian Department of Education (1989-92) and Assistant Director-General (Quality Assurance) in the NSW Department of School Education (1992-96).

underachieving<sup>15</sup> (Maasoumi et al. 2005) and minority students, and students from low SES backgrounds (McLaughlin and Drori 2000; Biddle and Berliner 2002; Bosworth 2011; Shin 2012).

This was an important corroboration of the controlled research results from previous studies such as Project STAR, SAGE, and others that indicate class size effects (McLaughlin and Drori 2000, 50):

The clearest result with respect to correlates of achievement is that average achievement scores are higher in schools with smaller class sizes.

Results from a three year longitudinal study of two cohorts of more than 10,000 4-7 year old English primary school children show that in smaller classes there is more individualised teacher support for learning. In a small class, a teacher will more easily be able to provide effective scaffolding for pupils in the form of individual attention, immediacy of feedback, sustained interactions, and flexible and effective questioning techniques (Blatchford et al. 2002). The authors of this study warn, however, that ‘some teachers varied in how successfully they adapted to the classroom contextual feature of class size’ (2002, 130). Further analysis of the educational consequences of class size differences (Blatchford et al. 2008; Blatchford et al. 2003) confirmed there was a clear effect of class size differences on children’s academic attainment over the first year.

The researchers concluded that results depend on how teachers adapt their teaching to different class sizes, and that more could be done in teacher training and professional development to address contextual features like size of class. In small classes, as would be expected, there were more individualised task related contacts between teacher and pupils, and a more active role for pupils. These results reinforced earlier research on children aged 4-5 years (Blatchford et al. 2005) and 7-11 years (Blatchford et al. 2007). They suggest that teachers in both large and small classes need to develop strategies for more individual attention, but also recognize the benefits of other forms of learning (for example, group work). Blatchford et al. (2009, 788) add that ‘teachers may be better equipped, when given the opportunities afforded by small classes, if they consider educational principles rather than specific practices’.

## **The role of pedagogy**

In a smaller Swiss study of 49 teachers and 898 students, Brühwiler and Blatchford (2011, 105) found that smaller classes led to higher academic learning progress, better student knowledge, and better classroom processes. They concluded that both smaller classes and teacher quality are independently important.

The role of class size as an immediate social psychological context affect[ed] student learning ... a more focused curriculum-related measure of students’ learning progress allows teaching in normal classroom conditions and therefore is likely to be more valid and authentic.

Finn agrees that how teachers use the smaller class is critical as it provides an ‘essential opportunity for teachers to be more effective and for students to become optimally involved in the learning process’ (2002, 551). Hattie, acclaimed for his

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<sup>15</sup> A study of Project STAR found that higher-achieving students benefit even more from being in small classes, mainly in kindergarten and first grade (Konstantopoulos 2007).

meta-analysis in *Visible Learning*, addresses how systems can improve the outcomes when class sizes are reduced (2008, 411):

The concept of [teaching] excellence in classes of 15–20 requires a shift in conception to the development of individuals, allowing students to become teachers (or self-regulators, self-evaluators, or self-learners), generating opportunity for richer tasks in the learning process, and having teachers become more co-learners with their students.

Hattie and others (e.g. Milesi and Gamoran 2006) have argued that moving from larger to smaller class size requires a shift in the concept of teaching excellence, and that it is not enough to just adapt their methods as they move to smaller classes, but it also requires a major re-conceptualization of what it means to be excellent as a teacher in a small class. Explaining why the greatest benefits have been achieved in the early years of schooling, Hattie suggests this is due to primary teachers being more flexible. They are more likely to adapt to new conditions that favour small group work and personal relationships, in contrast to later years' teachers who are more didactic in their pedagogy (Ehrenberg et al. 2001). Pedder, in analysing results from secondary classrooms in England, concludes that 'it is unsurprising if we find teachers maximising opportunities for pupils to learn in classes of different size in different ways' (2006, 231).

Hattie (2005, 417) concludes that:

Teaching practices that are conducive to successful learning are more likely to occur in smaller rather than larger classes, and these practices do not actually occur more in smaller classes because teachers have been prepared to, and indeed do, work with larger classes using more transmission practices and therefore they are not so equipped to adopt the more effective practices when they are given smaller classes.

While many point to Hattie's (2008) opus to refute any impact of class sizes, he in fact notes that smaller class sizes *do* have a positive effect on student learning, so that raising class size is 'poor policy' (2000, 88). It is germane to quote in full from his research:

Most research studies reported here agree that class size reductions do not affect all children equally. Both American and English evidence shows that children in the early years of schooling and those in the lowest ability groups (usually members of minority ethnic groups in the USA) appear to benefit the most from reducing the number of students in front of teachers (Hattie 2008, 88).

A review by Basci (2010) similarly concludes that the full gains of class size reduction cannot be achieved if it is implemented without paying attention to the ways in which teachers and students work together; the curriculum in use; and teachers' opportunities to learn new teaching strategies.

## Implications for policy and practice

Advocates for and against class-size reduction have engaged in or been accused of engaging in such cherry picking for as long as there has been research on this issue (Whitehurst and Chingos 2011, 3).

Policy makers, politicians and media too often discuss data about class sizes and impact on student learning without an evidence base, relying largely on second-hand research or anecdotes. Too frequently, advocates for particular positions select their

evidence, conveniently ignoring research that raises questions about their favoured position.

Education researchers have refuted the work of Hanushek and Hoxby. Berliner, along with many other education researchers, points out that Hanushek (and Jensen) do not examine class size directly, but rather a proxy measure intended to represent it (student-teacher ratio). While teacher quality (and the quality of teacher preparation) is at the heart of the effectiveness of almost any reform, conflating STR with class size reduction misses attention to the mechanisms thought to be at work in smaller classes. Berliner explains that Hanushek has not responded well to such criticisms; rather, he has found reasons to quarrel with their details and to continue publishing reviews, based on methods that others find questionable, claiming that the level of school funding and the things those funds can buy, such as smaller classes, have few discernible effects. Political conservatives have extolled his conclusions, complimented his efforts, and asked him to testify in various forums where class-size issues are debated. And in return, Hanushek has embedded his conclusion about the lack of class-size effects in a broader endorsement of a conservative educational agenda.

The highly selective nature of the research supporting current policy advice to both state and federal ministers of education in Australia is based on flawed research. The class size debate should now be more about weighing up the cost-benefit of class size reductions, and how best to achieve the desired outcomes of improved academic achievement for all children, regardless of their background. Further analysis of the cost-benefit of targeted CSR is therefore essential.

Reducing class sizes or adding extra teachers requires a new approach to teaching – without adequate professional development, the innovative 21st century teaching spaces provided as part of the Building the Education Revolution (Reid 2009) can do more harm than good. As Hattie (2005; 2008) explains, the problem is that teachers in smaller classes are adopting the same teaching methods as in their previously larger classes. Many of the more powerful influences Hattie identifies clearly show that teachers would be even more effective in smaller classrooms.

Many creditable and peer reviewed research projects have concluded that:

- The extra gains found for long-term attendance in small classes (in the early grades) continued to appear when students were returned to standard classes in the upper grades;
- Extra gains associated with long-term attendance in small classes (in the early grades) appeared not only for tests of measured achievement, but also for other measures of success in education;
- The greater gains experienced by students from groups that are traditionally disadvantaged in education were retained when those students were returned to standard classes;
- When it is planned thoughtfully and funded adequately, long-term exposure to small classes in the early grades generates substantial advantages for students, and those extra gains are greater the longer students are exposed to those classes;
- Extra gains from small classes in the early grades are larger when class size is reduced to fewer than 20 students;
- Evidence for the possible advantages of small classes in the upper grades and high school is so far inconclusive.



It is evident that for certain groups of children (indigenous, low SES and CLED students in the early years, and children with learning and behavioural difficulties), smaller class sizes and increased STRs are very beneficial. This holds for student learning outcomes, behavioural modification, and teacher satisfaction. As Lamb (2007) and Teese and Polesel (2003) have shown, with the increasing residualisation of public schools caused by the flight of cultural capital – itself a result of years of federal and state neglect and artificial choice programs promoting private schools – public schools have a larger proportion of problematic learners, disadvantaged and refugee families, and students at risk of school failure, but have larger class sizes than ever before in comparison with most private schools.

### **Class size reduction and equity**

CSR is about equity – any policy debate must start with the basic inequality of schooling, and aim to ameliorate the damage that poverty, violence, inadequate child care and other factors do to our children's learning outcomes. It must look at the strategies, pedagogies and practices that could mediate those differences, and 'the investments that we are willing to make as a society to put success in reach of all children' (Graue et al. 2005, 31).

If CSR is introduced in the current policy context of high-stakes testing, together with the inadequate funding highlighted by the Gonski Review (DEEWR and Gonski 2011) in Australia, we can expect minimal achievement outcomes. Additional resources to support class size reduction acknowledge the deep-seated inequities at the core of Australian schooling, but would not be enough.

CSR is part of a system of reforms and problems that need to be considered in a coordinated manner, in relation to both the practice and research of schooling. It necessitates implementation that 'connects the utilisation of the resources for class size reduction with all curricular, administrative, and institutional efforts that shape teaching and learning' (Graue et al. 2005, 32).

### **Recommendations for policy change**

The strongest hypothesis about why small classes work concerns students' classroom behaviour. Evidence is mounting that students in small classes are more engaged in learning activities, and exhibit less disruptive behaviour (Finn 2003; Finn, Pannozzo, and Achilles 2003).

The following policy recommendations and principles are therefore suggested:

- Class size is an important determinant of student outcomes, and one that can be directly determined by policy. Any attempts to increase class sizes will harm student outcomes (Schanzenbach 2014);
- The evidence suggests that increasing class size will harm not only children's academic results in the short run, but also their long-term success at school and beyond. Money saved by not decreasing class sizes may result in substantial social and educational costs in the future (Schanzenbach 2014);
- The impact of class-size reduction is greater for low-income and minority children;

- While lower class size has a demonstrable cost, it may prove the more cost-effective policy overall (Schanzenbach 2014) in closing the widening gap between the lowest and highest achievers, even in tight budgetary conditions;
- Professional development for all staff involved will increase their knowledge of, and preparedness to use, techniques that are particularly suited to small class environments (Harker 2003; Hattie 2005; 2008);
- Targeting of specific classes and specific year levels for CSR;
- Further research into the exact cost of targeted CSR for CLED communities and other disadvantaged learners;
- Further research into the specific teacher pedagogies that are more appropriate for smaller classes.

Schools should look at ways to produce the class size effect by lowering class size specifically for certain periods of instruction in numeracy and literacy classes. If class size could be reduced just for these lessons, using a combination of redeployment of existing staff and addition of special literacy and numeracy teachers, it would be theoretically possible to have small classes (average of 15 pupils) with a much lower additional cost. While this approach is used by some principals to deliver smaller class sizes in literacy and numeracy, it is not yet a general practice for disadvantaged groups and learners with higher needs. Slavin (1989) and Odden (1990) have suggested that targeted class size reduction combined with other proven methods of improving student achievement would be a more cost-effective means of increasing student achievement.

Differentiated staffing to reduce literacy and numeracy class size could make the cost of producing the small class effect about one-ninth greater rather than one-third greater (Productivity Commission 2012). In contrast to across-the-board reductions that have been prevalent to date in Australia and overseas, this targeted approach is a feasible way to make class size reduction more effective and more affordable.

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